REMARKS

Claims 1, 3, 5, 6, 9, and 11-16 remain pending in this application. Claims 4, 7, and 8 have been canceled without prejudice and without disclaimer of the subject matter recited therein. Claims 1, 5, 6, 9, and 11-13 have been amended. At least some of those changes have been made merely for clarification purposes only, and are not believed to affect the scope of the claimed subject matter.

Initially, the specification has been amended as to matters of form. No new matter is believed to have been added by those changes.[1]

Applicant notes with appreciation the indication in paragraph 9 of the Office Action that Claims 7, 9, and 12-16 would be allowable if rewritten in independent form and with no change in scope, and the indication in paragraph 10 of the office Action that Claim 6 would be allowable if rewritten or amended to overcome an objection (discussed below) set forth in the Office Action. Each of these claims will be addressed below.

In paragraph 2 of the Office Action, the specification was objected to because of grammatical errors appearing at page 21, lines 15-16 and page 50, line 14. Those portions of the specification have been amended to correct the grammatical errors, and thus the withdrawal of the objection set forth in paragraph 2 of the Office Action is respectfully requested.

In paragraph 3 of the Office Action, Claims 1, 3-9, and 11-16 were objected to, and the specification also was objected to as failing to provide proper antecedent basis

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[1] The change made to page 19, line 1 is supported by original Claim 16. The change made to page 13, lines 1-2 merely corrects an error in the number identifying the publication cited therein. That publication (58-199279) was made of record in this application in the Information Disclosure Statement filed on March 1, 2002.

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for various terms recited in those claims. In particular, paragraph 3 of the Office Action requires "Correction" of the terms "a human powered drive receiving portion" in Claim 1, "constraining means" in Claim 4, "a first human powered drive receiving portion" in Claim 6, "a second human powered drive receiving portion" in Claim 6, and "a propulsion wheel" in Claim 8.

Initially, cancelation of Claims 4, 7, and 8 renders the objection to those claims moot, although Applicant does not concede the propriety of the objection to those claims.

With regard to the term "human powered drive receiving portion" recited in Claim 1, Applicant notes that support and antecedent basis for that term *does* appear in the originally filed specification, at least at page 19, lines 16-17.

With regard to the term "constraining means" recited in Claim 4, the Examiner is respectfully requested to note that support and antecedent basis for that term are provided in the originally filed specification, at least at page 40, line 23.

As regards the "first human powered drive unit" and "second human powered drive unit" recited in Claim 6, support and antecedent bases for those units is provided by the right hand unit and left-hand unit, respectively, described at least at page 38, lines 7-10 of the originally filed specification (which has been amended herein to insert "first human powered drive unit" and "second human powered drive unit" on that page).

In view of the foregoing comments, it is believed that the objections set forth in paragraph 3 of the Office Action have been overcome, and their withdrawal is therefore respectfully requested.

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In paragraph 4 of the Office Action, Claim 6 was objected to because, the Office Action asserts, the "term 'circulatable' . . . is a non-existent word." Although Applicants does not concede the propriety of that objection, especially since MPEP 2111.02 clearly states that a patent applicant may be his own lexicographer, Claim 6 nonetheless has been amended to even further clarify that the first and second human powered drive receiving portions are capable of circulating (i.e., "circulatable" has been replaced with "capable of circulating"). As such, it is believed that the objection to Claim 6 set forth in paragraph 4 of the Office Action has been overcome, and the withdrawal of that objection is therefore respectfully requested. Claim 6 is deemed to be in condition for allowance.

Claim 5 was rejected under 35 U.S.C. 112, second paragraph, as indefinite, and paragraph 6 of the Office Action supports this rejection by asserting that there is no sufficient antecedent basis for the recited "driving receiving portion". While it is strongly believed that one skilled in the relevant art would clearly appreciate in view of the "drive receiving portion" recited in Claim 1, that the "driving receiving portion" of Claim 5 has sufficient antecedent basis in Claim 1, Claim 5 nonetheless has been amended to change "driving receiving portion" to "drive receiving portion". Since the latter term most certainly has sufficient antecedent basis in Claim 1, the Section 112 rejection is believed overcome, and its withdrawal is therefore respectfully requested.

Claims 1, 3-5, 8, and 11 were rejected under 35 U.S.C. 102(b) as anticipated by Japanese Patent 50-125437.

Cancelation of Claims 4 and 8 renders the Section 102(b) rejection of those claims moot.

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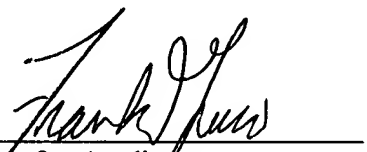
Claim 1 has been amended to incorporate subject matter which is substantially the same as that of now-canceled Claims 4 and 7, the latter of which, as pointed out above, was indicated in the Office Action as reciting allowable subject matter. Since Claim 1 now recites substantially similar subject matter as that of former Claim 7, Claim 1 is believed to be in condition for allowance.

The remaining, dependent claims in this application each depend from base Claim 1, and also are believed to be in condition for allowance, at least for the reason that each dependent claims depends from an allowable base claim.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable consideration and early passage to issue of the present application.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO SPECIFICATION

The paragraph appearing from page 3, line 22 to page 4, line 21, has been amended as follows.

If an attempt is made by a bicycle rider to climb a slope using the same speed increasing ratio as that used when the rider is running on flat land, a larger force is necessary, and whether or not the rider can continue riding the bicycle is determined by the strength of the legs of the rider. To the rider, a speed changing mechanism is an apparatus for trading the speed of applying [foce] force for the applied force, or an apparatus for optimizing the balance between speed of applying [foce] force and the applied force. In other words, if the muscular force becomes insufficient upon uphill riding, the speed changing mechanism is down-shifted to reduce the speed increasing ratio, allowing the muscles to move at a higher speed with a smaller amount of force, and yet producing the same amount of power. However, reducing the speed increasing ratio below a certain level is meaningless. That is, as the speed increasing ratio is reduced in order to keep the bicycle running, the rider must pedal faster to rotate the driving axle faster in reverse proportion to the decrease in the speed increasing ratio, which in turn causes the rider to reach his or her limit in physical capacity, and also increases the friction and/or vibrations for which the bearings and chain of the driving mechanism are responsible. Eventually, it becomes impossible for the rider to keep the bicycle balanced to continue riding.

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The paragraph appearing from page 4, line 22 to page 5, line 19, has been amended as follows.

The provision of a speed changing mechanism does not guaranty increase in the power input. Thus, it is obvious that there is a limit in the improvement in slope climbing performance. Therefore, a means for increasing the power input by a rider has been desired. Here, the power input by a rider means the amount of the power (amount of work per unit of time) transmitted from the rider of a bicycle, that is, a human-powered vehicle, to the bicycle through the driving mechanism of the bicycle. In a speed changing mechanism, the revolution of its output shaft is in inverse proportion to the amount of the torque output through the output shaft, the product of the two (revolution of the output shaft and the amount of the torque output through the output shaft) remains constant. In other words, a speed changing mechanism allows the speed increasing ratio, that is, the balance point between the muscular speed and force, to be changed in accordance with the [phisical] physical capacity of a rider and the riding conditions, in the direction to allow the rider to feel more comfortable. In principle, however, a speed changing mechanism does not change the overall amount of the power input by a rider, and therefore, the overall amount of the power output through the output shaft does not change.

The paragraph appearing at page 8, lines 10-26 has been amended as follows.

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As an invention similar to the aforementioned [human-power] human-powered vehicle driving mechanism, in which the crank length are rendered variable, there is U.S. Patent No. 4,872,695. According to this patent, the driving mechanism comprises a rear wheel fork, a pair of bearings, a pair of connecting rods, a pair of cranks, and a pair of pedals. The bearing is pivotally attached to the rear wheel fork, and one end of the connecting rod is slidably fitted in the bearing. The end portion of the crank is rotationally connected to the connecting rod, at a point slightly toward the end portion with respect to the center, and the pedal is attached to this end portion of the rod. Thus, as a rider steps on the pedal, the connecting rod acts as a lever having the bearing as its fulcrum, amplifying the applied force from the rider as it is transmitted to the crank.

The paragraph appearing from page 9, line 20 to page 10, line 10, has been amended as follows.

Figure 13 is a graph created by modifying Figure 7.3 in High-Tech Cycling (Human Kinetics, P.O. Box 5076, Campaign, [EL] IL, USA) in order to effectively describe the present invention, and shows the relationship between the rotational force (the tangential component of the force acting on a pedal) and crank angle. The change of the rotational force while an American bicycle racer was pedaling with a power of 350 W (which appears to represent the amount of work effected upon the crank per unit of time, although no clear definition is given in the above document), at 90 rpm, is plotted on the axis of ordinates, and the crank angle θ (clockwise angle with reference to the top dead center) is plotted on the axis of

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abscissas. According to this graph, the rotational force is highest when the crank angle θ is slightly greater than 90°, and begin to rapidly reduce as the crank angle θ is beyond approximately 120°.

The paragraph appearing from page 11, line 9 to page 12, line 12, has been amended as follows.

The human-powered vehicle driving mechanism disclosed in Japanese Laid-Open Patent Applications 58-133986, 58-221783, and 8-113180 comprise a pair of, that is, left and right drive trains, driving sub-mechanisms made up of a combination of a rope and pulleys, a combination of reciprocable chain and sprockets, and a rack and a pinion gear, correspondingly. In these driving mechanisms, the left and right drive [tranins] trains are mechanically connected to each other in such a manner that when one side is in the forward stroke, the other side is in the backward stroke (incidentally, the names used for the above described driving mechanism components were arbitrarily chosen by the inventors of the present invention for convenience in describing the components, and they do not necessarily match the names used in the original specifications). For example, as the pedal of the left drive train is stepped in its forward stroke, the applied force is transmitted to the pulley, sprocket, and pinion gear through the rope, chain, and rack, correspondingly, and therefore, the wheels connected to the pulley, sprocket, and the pinion, correspondingly, rotate. When the left drive train is in the backward stroke, the pedal of the left drive train is lifted by the power from the right drive train. Also

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during this period, the pulley, sprocket, or pinion gear in the left drive train is allowed to idle relative to the output shaft, by a free wheeling mechanism, such as a rachet or one-way clutch, with which their shaft portions are provided.

The paragraph appearing at page 13, lines 1-19, has been amended as follows.

Japanese Laid-Open Patent Application 58-199279 discloses an invention, according to which the driving mechanism is rendered reciprocal with the employment of a combination of a chain and a sprocket, and a spring is made to absorb a part of the energy transmitted as a rider steps on a pedal, so that the pedal is returned to the pre-stepping (original) pedal position, by the energy stored in the spring. However, this invention also has a problem in that unless the pedaling motion is not synchronized with the free [springd] spring movement, increase in the output cannot be expected (if the pedal is stepped on before it fully returns, a sufficient distance is not available for pedal acceleration to have positive work even in the case of this invention, the initial pedal speed, or the pedal speed at the very moment the pedal begins to be stepped on, is considered to be 0 m/s), and therefore, a significant amount of increase in bicycle speed cannot be expected.

The paragraph appearing at page 15, lines 14-19 has been amended as follows.

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The fourth invention provides a human powered drive mechanism according to the first invention, further comprising constraining means for constraining rotation of said [driving] drive receiving portion about a line included in a plane in which the endless driving member moves.

The paragraph appearing at page 15, lines 20-24 has been amended as follows.

The fifth invention provides a human powered drive mechanism according to the first invention, wherein said [driving] drive receiving portion is rotatable about an axis substantially perpendicular to a plane in which said endless driving member moves.

The paragraph appearing from page 16, line 15 to page 17, line 2, has been amended as follows.

The seventh invention provides a human powered drive mechanism according to the first invention, wherein said constraining means includes an arm having one end rotatably mounted to said [driving] drive receiving portion and a free crank having one end rotatably mounted to a frame and the other end rotatably mounted to the other end of the arm. The eighth invention provides a human powered drive mechanism for a human powered vehicle comprising a propulsion wheel, a rotatable member, a supporting member an endless driving member extended around said rotatable member and said supporting member, and a human

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powered drive receiving portion mounted to said endless driving member, wherein said propulsion wheel is connected with said rotatable member.

The paragraph appearing from page 18, line 24 to page 19, line 2, has been amended as follows.

The sixteenth invention provides a human powered drive mechanism according to the thirteenth invention, wherein said driving force receiving link is rotatably mounted to said constraining means by a [ball] roller bearing or a linear motion bearing such as a linear bush or the like.

The paragraph appearing at page 21, lines 1-7, has been amended as follows.

In such a case, even if a force is imparted to the pedal or the handle, the chain is not bent or twisted, and therefore, the chain is protected from deformation or damage. Additionally, the position of the force acting point is determined so that application of force is easy with less muscle and [bone] joint fatigue.

The paragraph appearing at page 21, lines 8-23 has been amended as follows.

In that case, it is preferable that the constraining means comprises a free crank rotatably mounted to the frame at an end thereof and an arm rotatably mounted to the other end of the free crank, and the arm is rotatably mounted to the drive receiving portion. Since the arm is rotatably mounted to the drive receiving portion, the rotation of the arm does not obstruct the motion of the chain, or the

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chain does not [received] receive abnormal force. The advantage of the constraining means of this type is in that use can be made, for support and connection for the free crank and/or the arm, with a ball bearing, cylindrical roller bearing or needle bearing with which the frictional loss is very small and which is light in weight and small in size and with which the dust sealing is easy.

The paragraph appearing from page 24, lines 19 to page 25, line 14, has been amended as follows.

In another example of the position of the center of rotation of [t] the free crank, the center of rotation of the free crank is disposed outside the oval orbit formed by the chain. In this case, when the radius of the pitch circle of the rotatable member and the radius of curvature of the supporting member (the radius of a pitch circle if the supporting member is in the form of a rotatable member), which constitute the pair, are the same, the rotational axis of the free crank is disposed on a line perpendicularly bisecting the line connecting the centers of the rotatable member and the supporting member. By doing so, the sum of the radius of rotation of the free crank and the radius of rotation of the arm can be made small, so that bending and torsion of the free crank and the arm are small, and therefore, the weight saving is accomplished. By selecting a length of the free crank such that a swing range of the free crank does not overlap the moving range of the endless driving member, the free crank can be disposed closer to the center line of the bicycle or the like than the arm, thus accomplishing compact human powered drive mechanism.

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The paragraph appearing from page 37, line 27 to page 39, line 4, has been amended as follows.

Figure 1 shows a general arrangement of the human powered drive mechanism according to the first embodiment of the present invention which is applied to a bicycle. Left and right human powered drive units are disposed parallel to each other. A line connecting the centers of a rotatable member and a rotatable supporting member extends vertically. Referring to Figure 1, a human powered drive unit at a front side of the sheet of the drawing, that is, the right side unit of the rider is called "right-hand unit" (also referred to as a "first human powered drive unit"), and the other is called "left-hand unit" (also referred to as a "second human powered drive unit"), the parts of the right-hand unit are assigned with double-digit reference numerals, and the parts of the left-hand unit are assigned with the like numerals with "00" added. Left and right machine elements which need not be discriminated, such as bearings, nuts and the like are given the same reference numerals. Figures 2 to 9 illustrate the human powered drive mechanism of this embodiment, and Figure 2 is a side view of the whole bicycle; Figure 3 is a view taken along a line Y-Y of Figure 2; Figure 4 is a view taken along a line X-X of Figure 2; Figure 5 is a view taken along a line A-A of Figure 3; Figure 6 is a view taken along a line B-B of Figure 3; Figure 7 is a sectional view taken along a line C-C of Figure 3; Figure 8 is a view taken along a line D-D; Figure 9 is a sectional view taken along a line E-E; and Figure 10 illustrates a modified example of the

mechanism shown in Figure 3. The following description will be made with respect to the right-hand unit, and the description with respect to the left-hand unit is omitted for the sake of simplicity, except for the necessary parts.

The paragraph appearing from page 39, line 5 to page 40, line 8, has been amended as follows.

In Figures 1 to 9, designated by reference numerals 1 and 2 are a first rotatable member (sprocket) and a first supporting member (sprocket) which are rotatably mounted to a circular cylinder 32 which is extended in the vertical direction, respectively; 100 and 200 are a second rotatable member (sprocket) and a second supporting member (sprocket), respectively; 3 and 300 are chains (endless driving members) trained on or extended around the second rotatable member 100 and second supporting member 200 and forming oval orbits; 4 and the 400 are pedals for driving the chains through driving force receiving links 12, 1200 and pedal shafts 17, 1700, respectively. The pedal 4 (first human powered drive receiving portion), 400 (second human powered drive receiving portion) are mounted at positions with phase deviation by 1/2 period. Designated [by10] by 10, 1000 and 11, 1100 are free cranks and arms which function to maintain perpendicularity between the pedal shafts 17, 1700 and the movement planes of the chains, respectively. Designated by 6 are a chain ring (third rotatable member) which is fixed on a driving shaft 15 together with the first rotatable member 1 and

second rotatable member by a nut 26 and spacers 24, 25; and 7 is a driven sprocket of a rear wheel driven by the chain ring 6 through a transmission chain 8. In Figure 7, the driving shaft 15 is rotatably supported by a boss 34 penetrated through and fixed on the circular cylinder 32 through a bearing 27. The circular cylinder 32 is welded to a connecting part of a down tube 30 and a seat tube 31 of the frame of the bicycle.

The paragraph appearing from page 44, line 23 to page 45, line 2, has been amended as follows.

As contrasted to the above described human powered drive mechanism of reciprocable linear motion type, at the initial stage of the kick in the power phase, the moving speed of the pedal is still high, there is no need of an acceleration distance, and therefore, in all the [human] power phase the human power is converted to the torque.

The paragraph appearing from page 49, line 18 to page 50, line 6, has been amended as follows.

When the third embodiment is applied to a bicycle, the power input is approx [1.18times] 1.18 times that of a conventional bicycle, on the assumptions that crank radius of the conventional bicycle is R; that average moving speeds of the pedals of the conventional bicycle and the bicycle of this example are the same; that in the linear range of the endless driving member at the power phase, the rotational

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force is kept at the same value as that at a crank angle of 90° given in Figure 13; that in the linear range of the endless driving member at the recovery phase, the rotational force is kept at the same value as that at a crank angle of 270° given in Figure 13; in the circular range of the endless driving member, the rotational force is equal to that of the corresponding crank angle given in Figure 13.

The paragraph appearing from page 50, line 7 to page 51, line 1 has been amended as follows.

In the physical meaning, the work is the product of the force acting on a point and the displacement of the point in the direction of the force, and therefore, if the displacement is zero, the work is zero no matter how large the force is. On the other hand, in order for a human body to apply a force, it is necessary to contract the muscle, and production of a force requires energy consumption. [Is] It is assumed that produced force integrated with time is substantially proportional to the energy consumed to keep the force. Then, the produced force is substantially proportional to the power (work rate) consumed by him or her. It is assumed that one foot of the rider applies a constant force F irrespective of the direction thereof in the power phase and that it is at rest in the recovery phase (F= 0). Then, time average consumption of human power is the same in both [the] the human powered drive mechanisms. Namely, the energy use efficiency is approx [1.18times] 1.18

times. In this embodiment, the length of the linear portion of the endless driving member is $0.5\pi R$, but if it is made longer, the power input is further increased.

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Twice Amended) A human powered drive mechanism comprising a rotatable member, a supporting member, an endless driving member extended around said rotatable member and said supporting member, [and] a human powered drive receiving portion mounted to said endless driving member, and constraining means for constraining rotation of said drive receiving portion about a line included in a plane in which the endless driving member moves, wherein said supporting member is rotatable, and said human powered drive receiving portion is [circulatable] capable of circulating with said endless driving member, and wherein said constraining means includes an arm having one end rotatably mounted to said drive receiving portion and a free crank having one end rotatably mounted to a frame and another end rotatably mounted to another end of the arm.

4. (Canceled).

5. (Amended) A human powered drive mechanism according to Claim 1, wherein said [driving] drive receiving portion is rotatable about an axis substantially perpendicular to a plane in which said endless driving member moves.

6. (Twice Amended) A human powered drive mechanism comprising a first rotatable member, a first supporting member, a first endless driving member extended

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around said first rotatable member and said first supporting member, a second rotatable member, a second supporting member, a second endless driving member extended around said second rotatable member and said second supporting member, a first human powered drive receiving portion mounted to said first endless driving member and a second human powered drive receiving portion mounted to said second endless driving member, wherein said first rotatable member and second rotatable member are coaxial with each other and are fixed to each other by a shaft member, said shaft member comprising a third rotatable member between said first and second rotatable members, wherein said first supporting member is rotatable, and said first human powered drive receiving portion is [circulatable] capable of circulating with said first endless driving member, and wherein said second supporting member is rotatable, and said second human powered drive receiving portion is [circulatable] capable of circulating with said second endless driving member.

7. (Canceled).

8. (Canceled).

9. (Amended) A human powered drive mechanism according to Claim [7] 1, wherein a rotation axis of said free crank is disposed outside an orbit formed by said endless driving member.

11. (Twice Amended) A human powered drive mechanism according to Claim [8] 1, wherein said mechanism is used with a bicycle.

12. (Amended) A human powered drive mechanism according to Claim [8] 1, wherein an inclination angle of a large curvature radius portion of said endless driving member relative to [the] a ground surface is variable.

13. (Amended) A human powered drive mechanism according to Claim [4] 1, wherein said endless driving member includes a plurality of links, and one of said links constitutes a driving force receiving link, wherein said driving force receiving link is provided with a shaft projected in a direction perpendicular to a plane in which said endless driving member moves, and said driving force receiving link is rotatably mounted to said constraining means through the shaft.

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